The Build of a 4X5 Inch “Pin Hole and Lens Convertible Camera”

(*A Light Weight Combination Camera - 2 Pound Weight)*

First off - This is not a new build. I built this camera in 2020 as a “*pandemic project*”. I had problems with the pinhole and lens focusing. After making a few readjustments, I feel comfortable as to the finishing and publishing this article to the public for their edification. As with just about everything I build - there are no diagrams, “blueprints”, just instructions of how I did it. – If anyone has a better idea, they are welcome to just use this article as a guide to make their own.

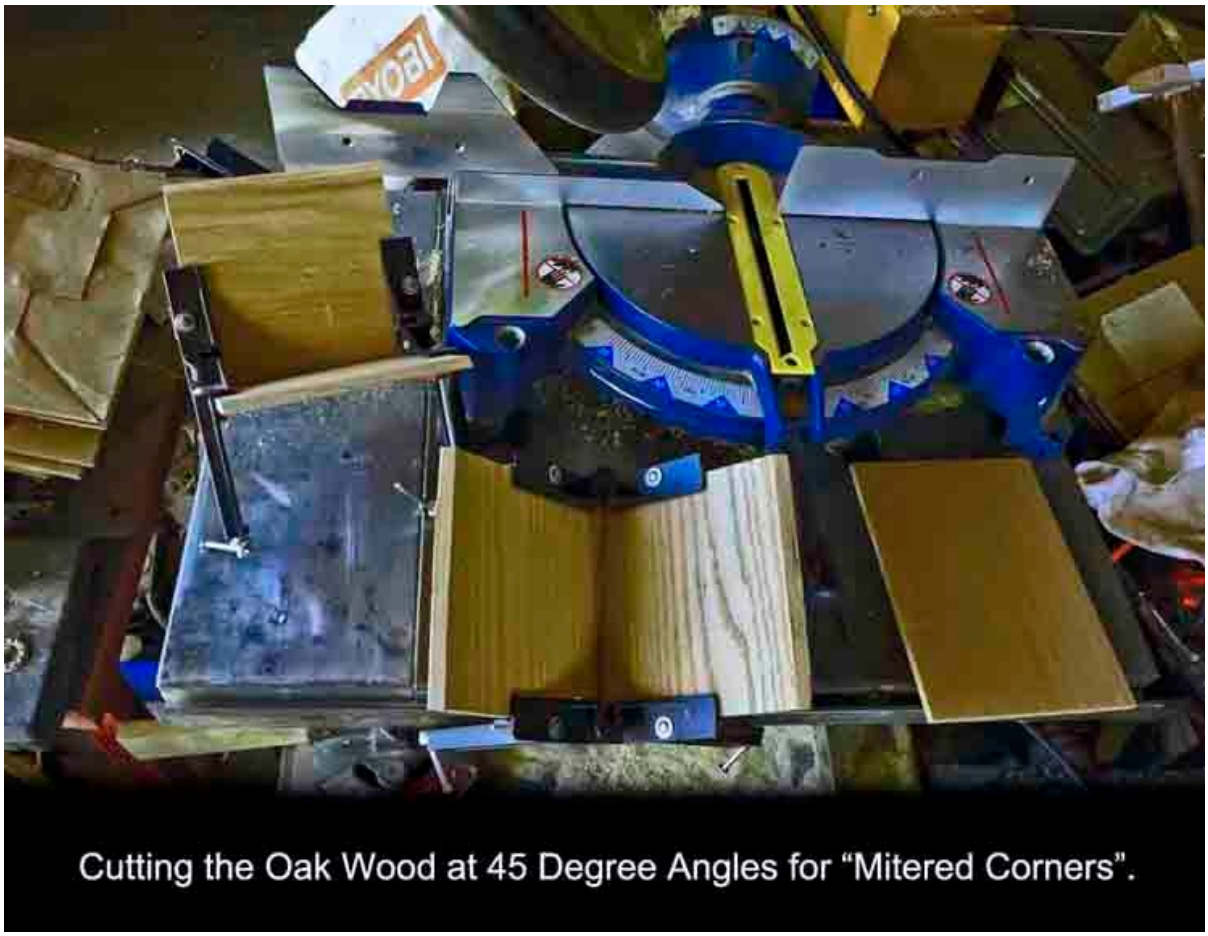
The build of this camera is very straightforward in it’s design, and it’s use *(It’s just a BOX = No Big Deal*). What is a little “different” is the ability to use a pinhole as well as a true camera lens. The lens that I have selected for this, is repurposed from a Kodak 1922 “pocket” folding camera. The lens specs are:

Kodak f-6.3 - f-32 -126mm Lens
From a Kodak "Pocket Camera #1" (1922)
Features a "On Lens Focusing" adjustment, ring. (From 2 Feet to Inf.)

Both the Pinhole and the Kodak lens are mounted on “Canon plastic body caps”, with a “Canon lens protector cap” mounted on the camera. This enables the most covenant method of changing the pinhole to the lens and back again. This quick-disconnect only requires an eighth of a turn to remove and replace.

The first thing to do is acquire some wood, a lens that would work at a distance determined by the focal distance. The one I used is a 4.5 inch infinitive focal distance (126mm). The pinhole opening would be .3 mm. This was only a simple solid box that will not move in and out as I have with previously builds (*i.e.= "Sliding-Box" cameras*).

The wood that I had in my "scrap" supply was 3/8" thick Red Oak. (Why buy, when you have this in your scrap pile.) And a small sheet of 3/16th thick plywood underlayment for the front and rear of the box. – I could have made the box totally from the plywood, and it would have been lighter in weight, however - oak looks much nicer. I cut the oak on a miter saw of the edges at a 45 degree angle for the fitting of the box. Putting these parts together will make the box light-tight and look better than just "butting" the parts together.



Cutting the Oak Wood at 45 Degree Angles for "Mitered Corners".

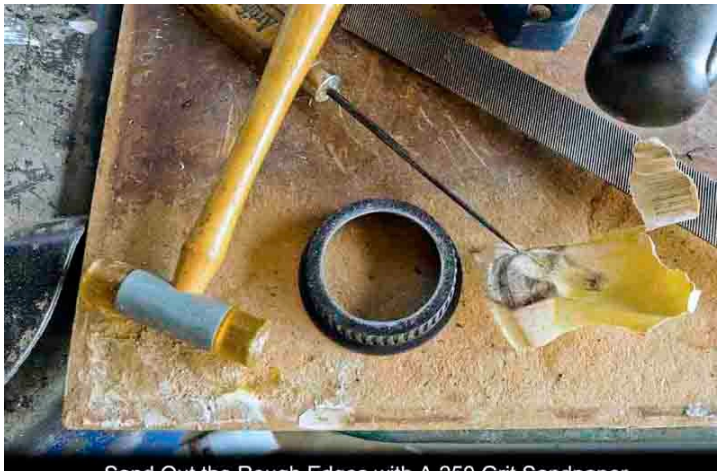
Taking care to have one of the four oak parts a ½ inch shorter for the top to admit a film holder, the next step glue the oak parts together using "angle clamps" to hold the parts evenly together. The result will be a four sided box with open ends - These will be the front and rear of the camera. While waiting for the glue to cure, I cut three ½ inch strips of wood to have as "*film holder guides*" at the rear of the camera. Finished cutting the plywood to fit the front and rear.

(*After the glue was cured on the box, I then glued the front and rear - and held them in place with clamps.*)

Fitted and Glued The Back to The Main Body of The Box
With “Holder Supports” In Place

After all the glued areas were cured - (the next day) - the box must be sanded so that all parts and surfaces are smooth. And on the bottom of this box I glued two one and a half inch wide - ½ inch thick strips of wood to accept a 1/4-20 threaded bushing which will serve as a tripod support trunnion to hold securely.

Checking The Fit of The Film Holder to The Image Plane Slot



Sand Out the Rough Edges with A 250 Grit Sandpaper
From the Sawed Hole.

Now comes the fitting checks for the 4X5 film holder – And the making of the “Quick Disconnect” lens and pinhole parts. This was very easy to cut, as the plastic was “scored” in the correct area - however - be very careful as not to split or over cut. With a little medium grit sandpaper I smoothed out the edges of the whole. (To make sure that there were no light leaks I used some strips of “*Sticky back Felt*” on the opening.)

Cut the Hole for The Plastic Lens Back Protector
With a "Hole-Saw".

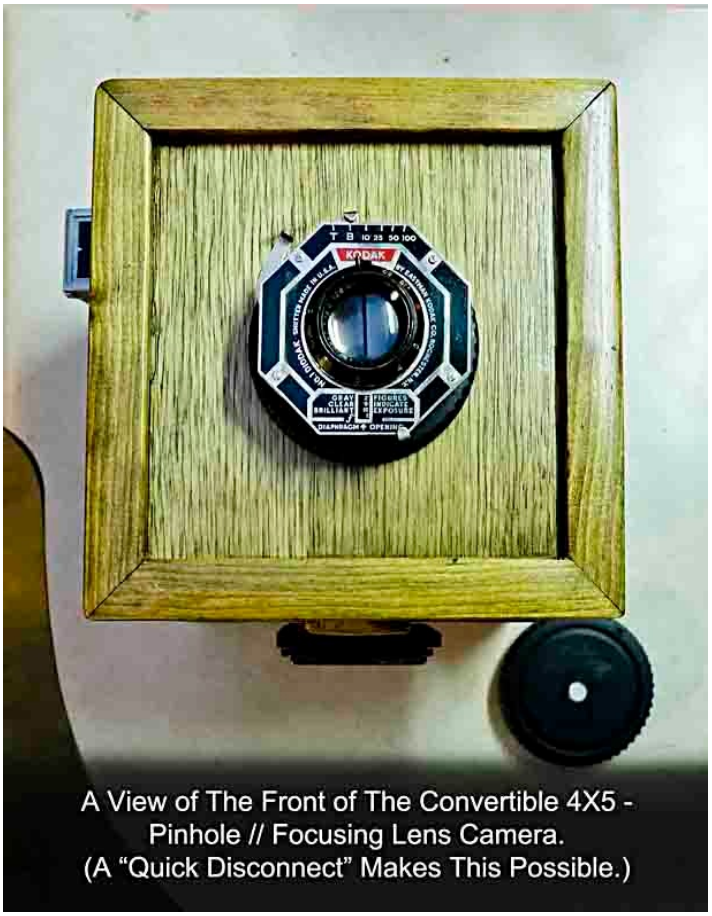
Using a proper sized "hole-saw", make a hole in the front plywood in the direct center. You may have to use a file to open the hole a little more to have the lens protector fit snugly in the hole. There is a flange on the plastic which I used super glue on to secure the plastic to the wood. The next step is to drill a ½ inch hole in the other plastic camera body protector. On the center of this hole is placed the thin part of aluminum which you will make a .3mm pinhole in the direct center. This is the "*lens*" for the pinhole part of the camera.

Also - if you choose - you can use some angle trim to "frame" the front and rear of the camera. (*You do not have to, however, I find that this makes the camera look a little better. (And It can hide some of the blemishes and saw marks on the wood parts*.)

The Final Construction Step is To Install a Tripod Mount
A Threaded Bushing of 1/4" - 20 TPI is A Standard for Tripods.

I had a few extra camera parts that where doing nothing but occupying space, so I put these on the camera body. A view finder from a Graflex - and a "*Range Finder*", for the Kodak lens operation. Looks like a "*real*" camera now.

View of The Back of The Camera
(Showing slot at top for the Film Holder)



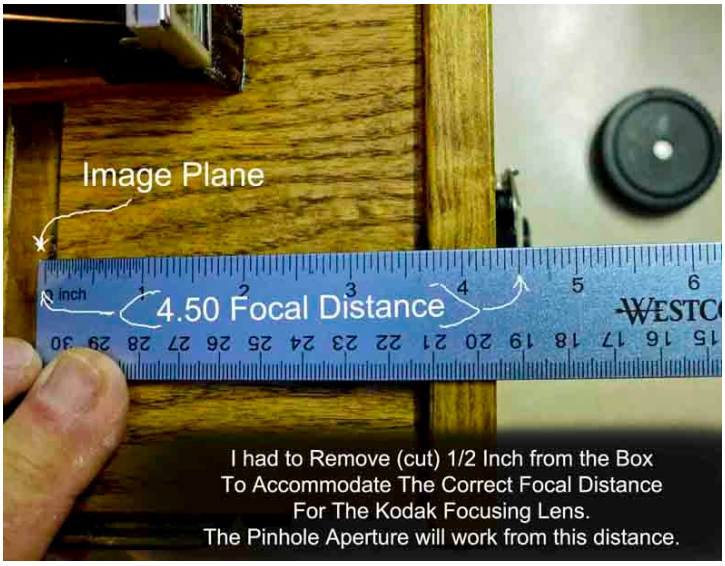


Image Plane
4.50 Focal Distance
I had to Remove (cut) 1/2 Inch from the Box
To Accommodate The Correct Focal Distance
For The Kodak Focusing Lens.
The Pinhole Aperture will work from this distance.

At first I had miscalculated the focal distance from the lens to the focal plane. I had ordinally "thought" that I was using a 5 inch lens. However, on trying to get a well focused image I found that I would have to cut off ½ inch to attain a clear image at infinitive distance. So - Now we are ready for making a few image quality tests.

Here are the statistics on the Pinhole:

Focal length ---------- 4.5 in
Pinhole diameter ---------- .3 mm (Coke Can Aluminum metal = .75"X.75")
F Stop ---------- f-381
Film Dimension ---------- 4 in
Optimal diameter ---------- 0.018 in
Optimal Focal Length ----- 1.99 in
Image Diameter ---------- 8.64 in
Angle Of View ---------- 47.9 degrees
Film Speed ---------- 6 ISO/ASA (PAPER)
(Sunny Day Exposure ---- 1.58 Mins)

As with most tests that I do - I shall make four each of the two different elements. With the "subjects" at different distances. And with the Kodak lens, different f-Stops. I will use a bright full sunny day, and too, I shall place still life objects in the shaded.

For the paper I will use:

Arista-EDU VC/RC and use two ISO settings.
For full sun, the ISO of six (6) - and for the shade, the ISO of three (3).

The chemical developer shall be my mix of Ansco - 120 (ratio of 1:4),
regular Stop and my mix of Sodium Thiosulfate for Fixer.

Development time will be somewhere between that of 45 seconds and 90 seconds for full development.

(*This, of course, is a "guesstimate" - I know, from practice, that these are the usual mixes and times that I have seen*.)

Here are the test results:

Above&Below is from the Kodak Lens

Above&Below is from the Pinhole (.3mm)

The setting of the Kodak was f-16 @ ½ Sec.

The Pinhole was .3mm @ 1.5 Min.

All in all - I am very pleased with the results of the tests from the Pinhole. The Kodak = Not so much. I think that I will have to readjust the distance of the Kodak Lens. The focus seems to be a little “off”. I may even use a different 4.5 inch (126mm) lens, perhaps one like a f- 4.5, rather than the Kodak at f- 6.3. What surprised me was the size of the Kodak lens in relationship to the pinhole. There is a difference, for sure, however, not that much.

I have tried to make pinhole cameras in the past, however, I have not had much success at doing that, till now that is. Perhaps I was looking for too much sharpness from them? I do know that this is the best combination of diameter in pinhole and focal distance that I could achieve. At the time of this writing, I was not aware of a online pinhole calculator, for the size of the pinhole and the focal distance. Now I know.

This was a fun project, and in that I most likely not use it for any of my serious photographic artwork, I know that others might consider this a nice little project. As I have “said” at the beginning of this article, I began this build in 2020, and just about gave up on making any use of it. The first tests were so terrible that I became discussed and put the seemingly useless box on a shelf in my workshop to collect dust. Every time I would glance up at it, I almost felt that I could hear it calling to me... ***“HEY! YOU!! - Finish working on me. Get me to work for you.”*** Well.... I hope that this damn thing will shut up now and leave me alone. (I have brought it inside - and I think that it likes being here with his other “brother” cameras.

As always - Thank you for the time in reading this article.

May The Light Be With You.

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